# An empirical survey of data augmentation for time series classification with neural networks

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## Abstract

In recent times, deep artificial neural networks have achieved many successes in pattern recognition. Part of this success can be attributed to the reliance on big data to increase generalization. However, in the field of time series recognition, many datasets are often very small. One method of addressing this problem is through the use of data augmentation. In this paper, we survey data augmentation techniques for time series and their application to time series classification with neural networks. We propose a taxonomy and outline the four families in time series data augmentation, including transformation-based methods, pattern mixing, generative models, and decomposition methods. Furthermore, we empirically evaluate 12 time series data augmentation methods on 128 time series classification datasets with six different types of neural networks. Through the results, we are able to analyze the characteristics, advantages and disadvantages, and recommendations of each data augmentation method. This survey aims to help in the selection of time series data augmentation for neural network applications.